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Loboda

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(54) **SETUP FOR MOBILITY SEPARATION OF IONS IMPLEMENTING AN ION GUIDE WITH AN AXIAL FIELD AND COUNTERFLOW OF GAS**

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(58) **Field of Search** 250/281, 282, 250/290, 292

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,487,386 A 1/1996 Wakabayashi et al.
6,512,226 B1 * 1/2003 Loboda et al. 250/282

OTHER PUBLICATIONS

Howard R. Morris et al, High Sensitivity Collisionally–activated Decomposition Tandem Mass Spectrometry on a Novel Quadrupole/Orthogonal–acceleration Time–of–Flight Mass Spectrometer, Rapid Communications in Mass Spectrometry, vol. 10, 889–896 (1996).

Andrej Shevchenko et al, Rapid "de Novo" Peptide Sequencing by a Combination of Nanoelectrospray, Isotopic Labeling and a Quadrupole/Time–of–flight Mass Spectrometer, Rapid Communications in Mass Spectrometry, vol. 11, 1015–1024 (1997).

* cited by examiner

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(57) **ABSTRACT**

To control movement of ions in a mass spectrometer, an ion guide has means for generating an electric field along the ion guide, and also provision for generating a gas flow along the ion guide. This then subjects ions to forces, an electric field force and a drag force. These can be set to control motion of ions as desired. The ion guide can form part of ion mobility section, in which case the forces can be set to enhance separation of ions and to control elution of different groups of ions from the ion mobility spectrometer for subsequent analysis. Eluted ions can be selected to further analysis, e.g., collisional fragmentation followed by mass analysis in a time-of-flight instrument. The technique is applicable to other elements of a mass spectrometer; for example, the fragmentation cell can be configured so that ions therein are subjected to both drag forces and electric forces, to control movement thereof.

29 Claims, 6 Drawing Sheets